

What is claimed is:

1. A method of degrading plastic in the presence of a biosurfactant.
2. A method of Claim 1 wherein the biosurfactant is a plastic-binding protein.
- 5 3. A method of Claim 1 or 2 wherein the plastic is degraded with the use of a plastic-degrading enzyme.
4. A method of Claim 1, 2 or 3 wherein the biosurfactant and the plastic are mixed in such a condition that a hydrophobic interaction between them will be strengthened so that the biosurfactant will attach effectively to the plastic.
- 10 5. A method of Claim 4 comprising a step of mixing the biosurfactant and plastic in a low water activity condition, and a step of degrading the plastic with the use of the plastic-degrading enzyme in a high water activity condition.
6. A method of Claim 4 comprising a step of mixing the biosurfactant and plastic in a high salt-concentration condition, and a step of degrading the plastic with the use of the plastic-degrading enzyme in a low salt-concentration condition.
- 15 7. A method of any one of Claim 1 – 6 comprising making the plastic in contact with *Aspergillus oryzase* or *Aspergillus sojae*, degrading the plastic with the use of the biofurfactant, and the plastic-degrading enzyme produced by them *in situ*.
8. A method of producing a useful substance from plastic comprising degrading the plastic by making the plastic in contact with a microorganism and further converting a component of the degraded plastic into a useful substance with the use of the microorganism.
- 20 9. A method of Claim 8 wherein the useful substance is selected from the group consisting of protein, a first metabolite, a second metabolite, and a biosurfactant.
- 25 10. A method of Claim 8 or 9 wherein the useful substance is an extracellularly secreted substance.

11. A method of any one of Claim 8 – 10 which uses a transformant prepared by recombination with the use of a gene encoding an enzyme involved in biosynthesis of the useful substance so as to highly express the enzyme.
12. A method of any one of Claim 7 – 10 wherein the degradation of the plastic is promoted  
5 with the coexistence of a surfactant and/or the plastic-degrading enzyme.
13. A method of Claim 12 wherein the surfactant and/or the plastic-degrading enzyme are added from an outside of a reaction system to promote the degradation of the plastic.
14. A method of Claim 12 o 13 which uses a transformant prepared by recombination with the use of a gene encoding of the biosurfactant and/or the plastic-degrading enzyme so  
10 as to highly express them.
15. A method of Claim 14 wherein the gene encoding of the biosurfactant and/or the plastic-degrading enzyme is controlled by a promoter for constitutive expression.
16. A method of Claim 14 wherein the gene encoding of the biosurfactant and/or the plastic-degrading enzyme is controlled by a promoter for inducible expression.
- 15 17. A method of Claim 12 or 13 wherein a biosurfactant is used as the surfactant.
18. A method of degrading a plastic comprising making the plastic in contact with a microorganism in the coexistence of a biosurfactant and/or a plastic-degrading enzyme and degrading the plastic with the use of the microorganism.
19. A method of Claim 18 wherein the biosurfactant and/or the plastic-degrading enzyme  
20 are added from an outside of a reaction system to promote the degradation of the plastic.
20. A method of Claim 18 or 19 which uses a transformant prepared by recombination with the use of a gene encoding of the biosurfactant and/or the plastic-degrading enzyme so as to highly express them.
21. A method of Claim 20 wherein the gene encoding of the biosurfactant and/or the plastic-degrading enzyme is controlled by a promoter for constitutive expression.  
25
22. A method of Claim 20 wherein the gene encoding of the biosurfactant and/or the plastic-degrading enzyme is controlled by a promoter for inducible expression.

23. A method of any one of Claims 18- 22 wherein the biosurfactant and/or the plastic-degrading enzyme are derived from *Aspergillus* fungus.
24. A method of Claims 23 wherein *Aspergillus* fungus is *Aspergillus oryzae*.
25. A method of any one of Claims 18 – 24 wherein the plastic-degrading enzyme is  
5 selected from the group consisting of esterase, protease, peptidase, lipase, cutinase and serine hydrolase and any mixture thereof.
26. A method of any one of Claims 18 – 25 wherein hydrophobin is used as the biosurfactant, and cutinase is used as the plastic-degrading enzyme.
27. A method of any one of Claims 7 - 26 wherein the plastic is biodegradable plastic.
- 10 28. A method of Claim 27 wherein the plastic is selected from the group consisting of polyester, polyurethane, polypropylene, polyvinyl chloride, nylon, polystyrene, starch, and any combination thereof.
29. A method of Claim 28 wherein polystyrene is selected from the group consisting of poly butylene succinate (PBS), poly lactic acid (PLA), poly butylsuccinate adipate (PBSA),  
15 aliphatic polyester, polycaprolactone and any combination thereof.
30. A method of any one of Claims 7 – 29 wherein the microorganism is a filamentous bacterium.
31. A method of Claim 30 wherein the filamentous bacterium is *Actinomycetes*.
32. A method of Claim 31 wherein *Actinomycetes* is *Streptomyces* genus.
- 20 33. A method of Claim 32 wherein *Streptomyces* genus is *Streptomyces griseus* or *Streptomyces sericara*.
34. A method of any one of Claims 7 – 29 wherein the microorganism is an eucaryotic filamentous fungus.
35. A method of Claim 34 wherein the eucaryotic filamentous fungus is selected from the  
25 group consisting of genera of *Aspergillus*, *Penicillium*, *Trichoderma*, *Rhizopus*, *Magnaporthe*, *Metarhizium*, *Neurospora*, *Monascus*, *Acremonium* and *Mucor*.

36. A method of Claim 35 wherein the *Aspergillus* is selected from the group of *Aspergillus oryzae*, *Aspergillus sojae*, *Aspergillus niger*, *Aspergillus awamori*, *Aspergillus kawachii*, *Aspergillus nidulans*, *Aspergillus tamari*, and *Aspergillus repens*.
37. A method of any one of Claims 7 – 36 wherein the plastic is made in contact with the microorganism in a liquid culture system.
38. A method of any one of Claims 7 – 36 wherein the plastic is made in contact with *Aspergillus oryzae* in a solid culture system.
39. A transformant prepared by recombination with the use of at least one DNA selected from a group consisting of DNA comprising a gene encoding the surfactant, DNA comprising a gene encoding the plastic-binding protein and DNA comprising a gene encoding the useful substance.
40. A transformant of Claim 39 wherein the surfactant is hydrophobin derived from *Aspergillus oryzae*.
41. A transformant of Claim 39 wherein the plastic-binding protein is cutinase derived from *Aspergillus oryzae*.
42. A transformant of Claim 39 wherein the surfactant is hydrophobin derived from *Aspergillus oryzae*, the plastic-binding protein is cutinase derived from *Aspergillus oryzae* and the useful substance is  $\alpha$ -amylase.
43. A transformant of any one of Claims 39 - 42 which is *Aspergillus* fungus.
44. A transformant of Claim 43 which is derived from *Aspergillus oryzae*.
45. A method of any one of Claims 1 – 38 wherein the plastic is comprised as one element of a composite material.

46. A DNA comprising a base sequence encoding the following polypeptide (a) or (b):

- (a) polypeptide having an amino acid sequence that is the same or substantially the same as that represented by SEQ No.3,
- (b) polypeptide having an amino acid sequence of (a) wherein a part of amino acid residues are replaced, deleted, or added, and having substantially the same function as the hydrophobin.

5        47. A DNA of the following (a) or (b):

- (a) DNA comprising a base sequence represented by SEQ ID No.3 or its partial sequence,
- 10      (b) DNA being hybridized with a base sequence complementary to the DNA comprising the base sequence in (a) under stringent conditions, and having substantially the same function as the DNA (a).

48. A DNA comprising a base sequence encoding the following polypeptide (a) or (b):

- (a) polypeptide having an amino acid sequence that is the same or substantially the same as that represented by SEQ ID No.4 or No.5,
- 15      (b) polypeptide having an amino acid sequence of (a) wherein a part of amino acid residues are replaced, deleted, or added, and having substantially the same function as the plastic-degrading enzyme.

49. A DNA of the following (a) or (b):

- 20      (a) DNA comprising a base sequence represented by SEQ ID No.4 or No.5 or its partial sequence,
- (b) DNA being hybridized with a base sequence complementary to the DNA comprising the base sequence in (a) under stringent conditions, and having substantially the same function as the DNA (a).

50. A DNA comprising a base sequence encoding the following polypeptide (a) or (b):

- (a) polypeptide having an amino acid sequence that is the same or substantially the same as that represented by SEQ ID No.6 or No.7,
- (b) polypeptide having an amino acid sequence of (a) wherein a part of amino acid residues are replaced, deleted, or added, and having substantially the same function as the plastic-binding protein.

51. A DNA of the following (a) or (b):

- (a) DNA comprising a base sequence represented by SEQ ID No.6 or No.7 or its partial sequence,
- (b) DNA being hybridized with a base sequence complementary to the DNA comprising the base sequence in (a) under stringent conditions, and having substantially the same function as the DNA (a).

52. A protein encoded by the gene of any one of Claims 46 – 51.